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(54) Analogue clock

(57) An analogue clock has a stationary disc 17 and a rotating disc 19, portions 15, 18 of which are graduated such that they form a rotary vernier. The graduations of the vernier are arranged and illuminated such that as a fixed mark 12 on the disc 19 rotates one revolution every twelve hours and indicates the time in hours, the vernier graduations enable minutes to be read. The disc 17 has eleven transparent markings 15 and the disc 19 has twelve markings 18, the disc being illuminated from the rear. A further set of markings may be provided to display seconds. The disc 19 is driven e.g. in steps of one eleventh of an hour by a concealed motor. Marks 14 in cooperation with an I.R. sensor ensure accurate positioning of the disc.

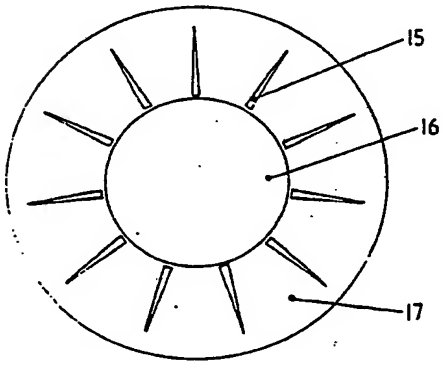

FIG 3

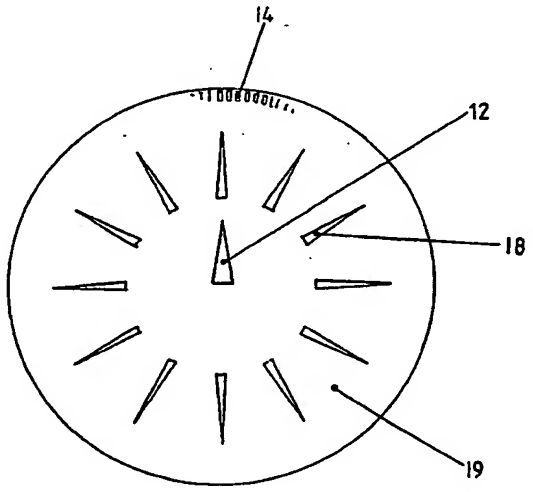

FIG 4

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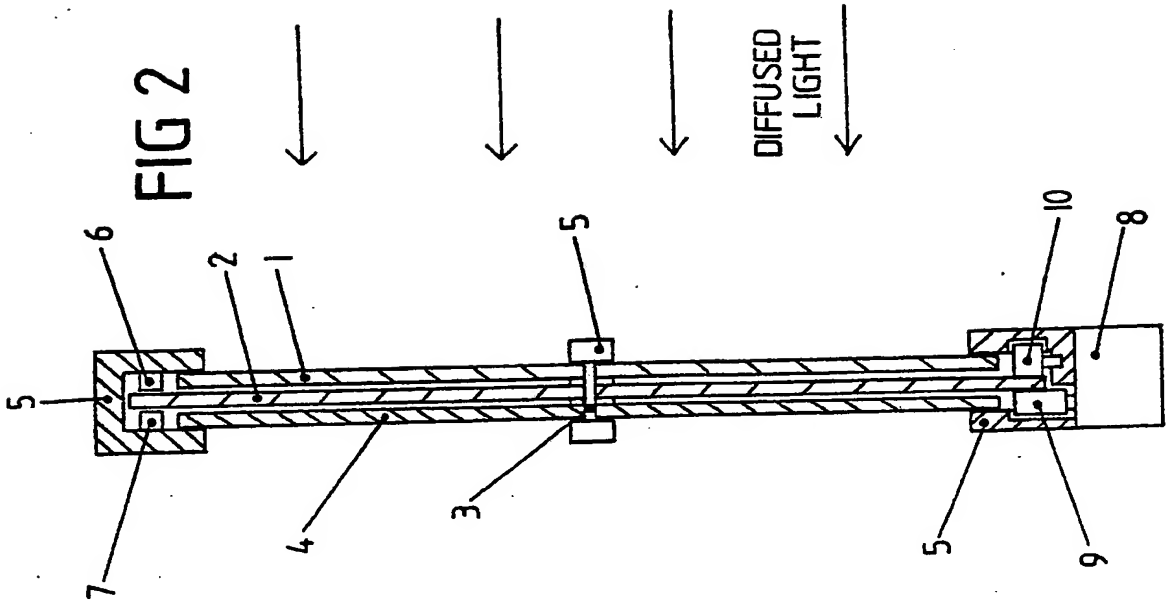
FIG 2



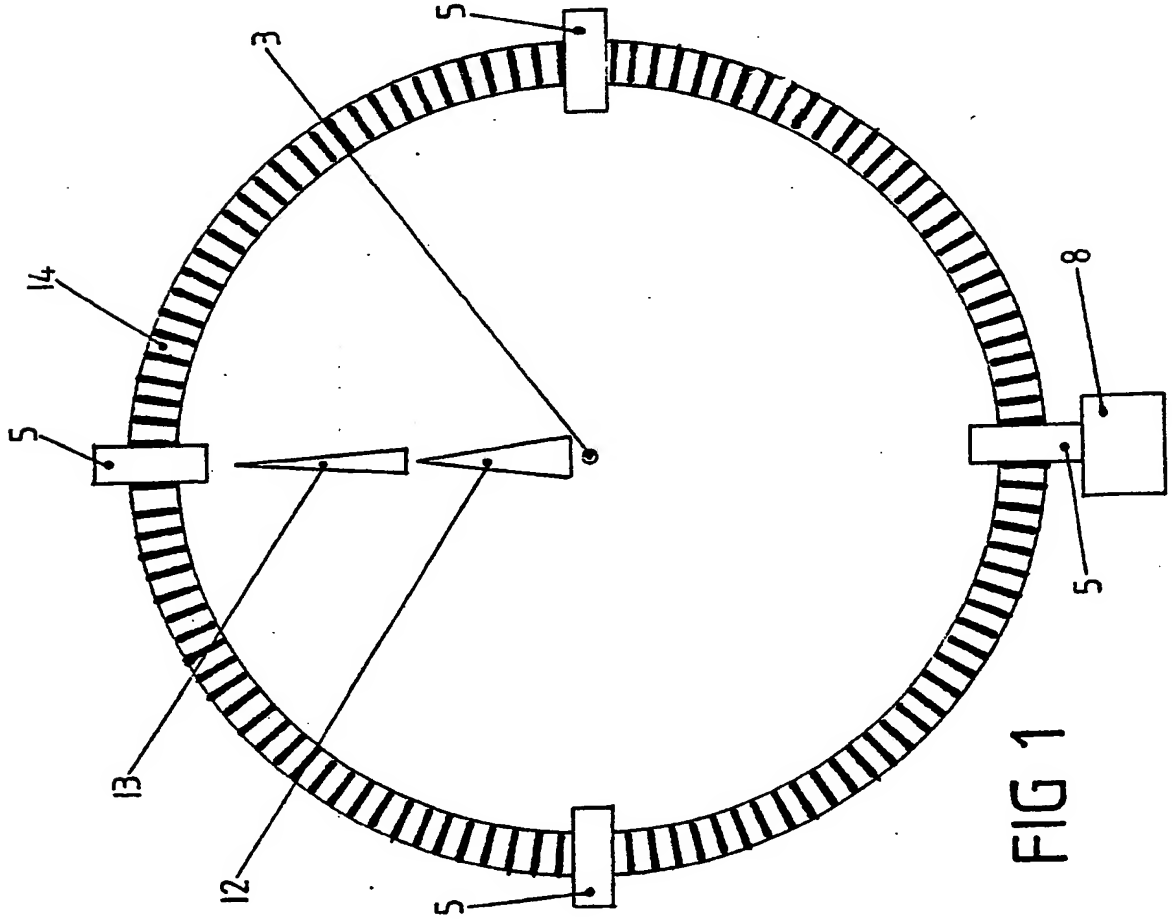


FIG 1

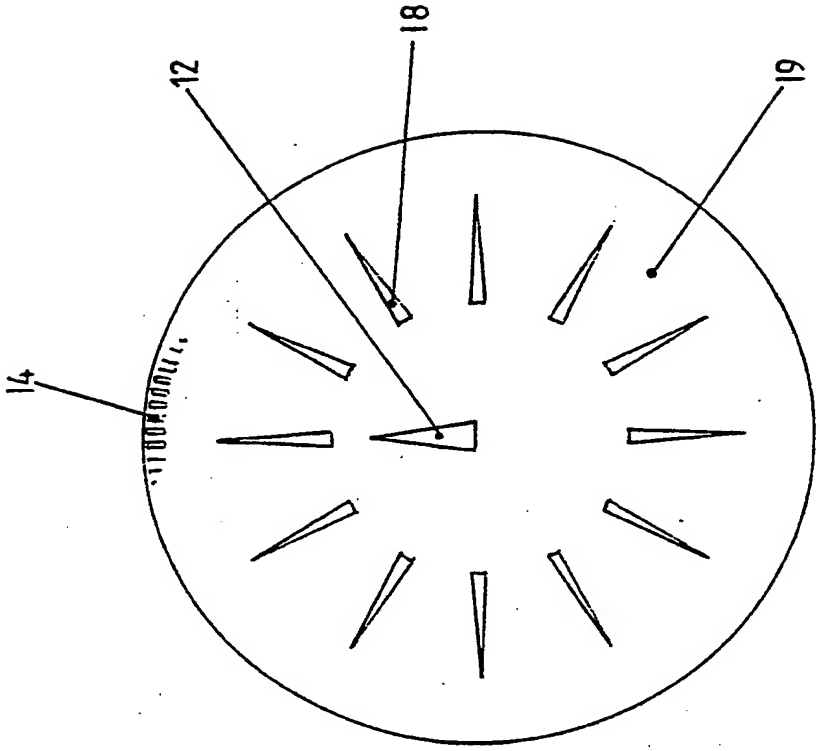


FIG 4

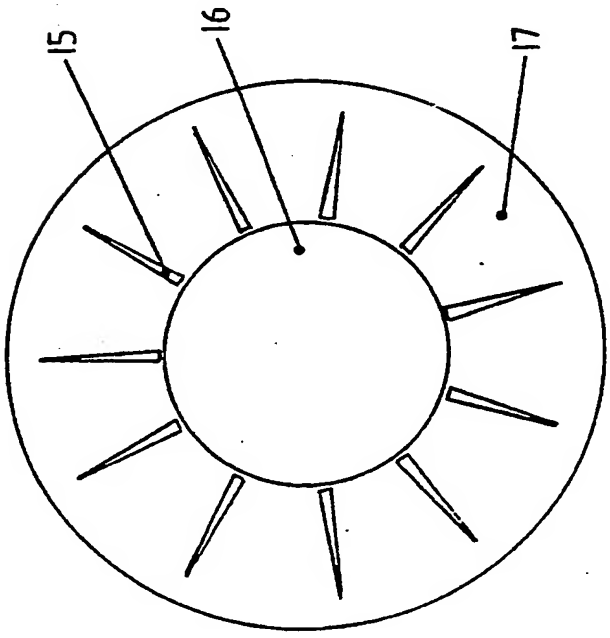


FIG 3

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ANALOGUE CLOCK

This invention relates to a decorative analogue clock.

Analogue clocks are well known devices which indicate the time of day. This is commonly done by means of two hands mounted in the centre of a circular dial. The periphery of the dial is marked with twelve equal angular divisions, each one corresponding to one hour. Some clocks also subdivide each of these divisions into five equal divisions, which correspond to minute steps, there being sixty in one full revolution. One of the hands, normally the shortest in length, moves one full clockwise revolution every twelve hours, thus the hour time can be read by noting the position of the hour hand in relation to the twelve hour markings. The other hand, normally the longer of the two, rotates one full revolution every hour, thus the minutes of each hour can be read by noting the position of the minute hand in relation to the sixty minute divisions around the circular dial. Both hour and minute divisions begin counting at the top position of the dial, so for example, twelve o'clock in denoted by both hands pointing to the upper-most position on the dial. The hands in a conventional clock are physical entities, pivoted in the centre and driven in a clockwise direction around a common axis by a mechanism which keeps their relative motion synchronised. This mechanism involves the use of at least two precision moving parts.

According to the present invention, this clock has a dial and displays an hour hand and a minute hand as does a conventional clock. The dial, however, is comprised of two circular elements mounted close together, sharing a common central axis of rotation. These elements have areas which are transparent to light and areas which block out light. One of the circular elements is stationary, while the other rotates at a speed of one revolution every twelve hours. The hands are not physical entities as in a conventional clock, but are made visible as light passes through two coincident transparent areas on the adjacent circular elements. The light may reach the observer by any direct or indirect means, using reflection, refraction and transmission. The hour hand is marked on the rotating circular element by an appropriately shaped transparent area. This area is seen to rotate once every twelve hours. It is made visible by allowing an area of the stationary circular element to be transparent such that the shape of the hour hand is fully and clearly seen, whatever its angular position may be.

The minute hand is made visible when two transparent areas on the rotating and the stationary circular elements become aligned allowing light to pass through both and so to the observer. This clock differs from a conventional clock in that eleven equi-spaced minute hands are made to appear and disappear, in the manner of a rotary vernier, in succession around the dial of the clock as the rotating

circular element moves. Only one minute indicator is fully visible at any one time. The minute indicators are made visible by having eleven identical equi-spaced radially positioned transparent shapes around the stationary circular element at a constant radius; and twelve equi-spaced transparent shapes of the same form, around the rotating circular element at the same constant radius. The shape of the minute indicator can be anything but the ease of discerning which two shaped areas are most closely aligned for any particular angular position of the rotating circular element is affected by the shape chosen. There are only eleven positions per hour when the minute indicator becomes fully visible so the time is most easily read in intervals of one eleventh of each hour. However, when the shapes which form the minute indicator are only partially aligned, the visible area changes and this enables, if required, interpolation to be carried out to determine the time in smaller divisions of each hour than one eleventh. The rotating element can be made to rotate continuously at the speed of one revolution every twelve hours, which would enable interpolation between the elevenths of each hour to be carried out. Alternatively, the rotating element could be rotated in steps. It could quickly move one eleventh of one hour divsion and remain stationary for the bulk of that period of time, thereby indicating the time more approximately, but making the

minute indicator more distinct for a greater period of time.

Appropriate means is provided to support the two circular elements and to allow the rotation of one to take place as required by the specific application. One possible means for rotating the moving circular element and maintaining motion synchronised with time is described as follows. The rotating circular element is provided with a number of evenly spaced transparent areas around its edge, the spaces in between occluding light. Each non-transparent area corresponds to the angular position where a minute indicator is fully visible. A sensor is positioned to pass an infra-red beam through the element and adjusted such that an 'on' signal is generated when the transparent areas are aligned with the sensor and an 'off' signal is produced when a non-transparent area occludes the infra-red beam.

An electronic circuit which contains for example, a quartz crystal oscillator and other necessary control components is used to generate a pulse every one eleventh of an hour. This pulse is passed to circuitry which switches on a motor or other device which begins to rotate the movable circular element in a clockwise direction as viewed from the observer's position. The infra-red sensor detects a transparent area as the element rotates. When the sensor detects a non-transparent area on the edge of the element

it sends an 'off' signal to the control circuitry which in turn switches off the driving apparatus. The position of rest corresponds to a fully aligned minute indicator. The process is repeated every eleventh of an hour, when the accurate pulse from the crystal oscillator initiates the driving apparatus. The power to the sensor is only supplied while the drive apparatus is on, which saves power and enables a battery power source to be used in cases where appropriate. The accuracy of the positioning of the rotating circular element is thus dependent on the positioning of the spaces around the edge of the element. This can be accurately achieved for example, by a photographic printing process. The drive apparatus does not affect the accuracy of the clock in any significant way and so this enables the use of quite a simple drive system, without gears and other precision mechanical components, if desired. A source of illumination to enable the reading of the clock should be provided as necessary. This clock enables the time to be read on an analogue dial with only one visible moving part and it therefore eliminates the need to use precision geared components to synchronise the motion of the hour hand and the minute hand as in a conventional clock.

It is further possible to develop a version of this clock which gives an approximation of the time in seconds as well as hours and minutes. Such a clock would have another set of second indicators radially positioned about

the common centre. There would be a very large number of indicator divisions but they could be produced again, for example, by a photographic printing process. If the rotating element was moved in much smaller time steps than one eleventh of an hour, the second indicator could be made to appear to give one full revolution every minute, for example. This would make it possible to produce an analogue clock capable of displaying hours, minutes and seconds with only one visible moving part.

A specific embodiment of the invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 shows the clock in the normal viewing position with the hands indicating twelve o'clock.

Figure 2 shows in section the clock with the drive apparatus, bearing, sensor and other parts required for assembly.

Figure 3 shows the stationary disc.

Figure 4 shows the rotating disc.

Referring to the drawings the clock comprises a stationary disc 1 and a rotating disc 2. As shown in Figure 2, the rotating disc is supported on a bearing 3 which is fitted through the stationary disc and the transparent front cover 4. The stationary disc and the front cover are

releasably secured to four brackets 5, for example by screws (not shown), which hold the discs in alignment. The four brackets are attached to the front cover and the stationary disc at the twelve o'clock, three o'clock, six o'clock and nine o'clock positions. The bracket at the twelve o'clock position houses the infra-red sensor which comprises a transmitter 6 and a receiver 7. The cables which connect the sensor to the control circuit box are not shown. The bracket at the six o'clock position is releasably secured to the drive apparatus 8, for example, by screws (not shown). In this example, the drive apparatus comprises an electric motor (not shown) with an output shaft 9 which has a rubber surface. The output shaft is held in contact with the rotating disc by a roller 10 which rotates on a shaft 11. The shaft is permanently fixed to the bracket at the six o'clock position. The output shaft rotates slowly and turns the rotating disc by friction at the point of contact. The cables which supply power to the motor are not shown. The control circuitry is housed for example, in a suitably insulated box (not shown). The control circuitry is connected to the clock for example, by flexible electrical cables (not shown).

In order to view the clock a diffuse light source is placed behind the clock to illuminate it as shown in Figure 2. In Figure 1 the clock is reading twelve o'clock and the hour hand 12 and minute indicator 13 appear bright

to the observer. The transparent area 14 around the periphery of the rotating disc also appears bright. The rest of the dial of the clock appears darker than the transparent areas described above.

Figure 3 shows the stationary disc with eleven transparent minute indicators 15. The centre area is also transparent and shaped in a circle 16. This area allows light to pass through to illuminate the hour indicator 12 shown in Figure 4. The remaining area 17 of the stationary disc is non-transparent. Figure 4 shows the rotating disc with alternating transparent and non-transparent areas 14 around its perphery. These are shown in part on Figure 4. The twelve minute indicators 18 are also shown. The remaining area 19 of the rotating disc is non-transparent.

The rotating disc is driven round by the drive apparatus in steps corresponding to a time interval of one eleventh of an hour. This time interval is accurately determined, for example, by an electronic circuit containing a crystal oscillator and other necessary components. At the start of each time interval the drive apparatus and the sensor are switched on. This causes the rotating disc to move in an observed clockwise direction about its central axis. The sensor detects the transparent spaces around the periphery of the rotating disc and sends an electrical signal to the drive apparatus which keeps it switched on. When the sensor detects a non-transparent area around the

periphery of the rotating disc it causes the drive apparatus to be switched off. The position at which the disc comes to rest is made to correspond to the position where the minute indicator is fully visible to the observer. This process is repeated every eleventh of an hour, and by this means, accurate time keeping is maintained.

CLAIMS

1 An analogue clock comprising two adjacent discs, one stationary and one rotating, whose graduations together form a rotary vernier wherein hours are indicated by a fixed mark on the rotating disc which turns through one revolution every twelve hours, and minutes and or seconds are indicated by coincident vernier graduations, so enabling the observer to tell the time.

2 An analogue clock as claimed in Claim 1 wherein support means is provided for the rotating disc to enable it to rotate freely about a given axis.

3 An analogue clock as claimed in Claim 1 wherein guide means is provided to maintain the two discs in close proximity whilst allowing freedom of rotation of the rotating disc.

4 An analogue clock as claimed in Claim 1 or Claim 2, wherein drive means is provided to turn the rotating disc in a regular and repeatable manner about a given axis.

5 An analogue clock as claimed in Claim 1 wherein illumination means are provided to enhance coincident elements of the rotary vernier such that they are more readily visible.

6 An analogue clock as claimed in Claim 3 wherein graduations may be provided on the rotating disc to synchronise the driving apparatus with the rotating disc.

7 An analogue clock substantially as described herein with reference to Figures 1-4 of the accompanying drawing.

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